Performance Measures in Radiology

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Performance measures in radiology play an increasingly significant role in health care quality assessment and now form the basis for a variety of pay-for-performance programs, including those administered by CMS. This article introduces the measure development process, beginning with topic selection, followed by measure development and testing, National Quality Forum endorsement, and implementation. Once implemented, measures may undergo further testing and be re-endorsed, modified, or retired. Radiologists should familiarize themselves with the measures relevant to their practice, develop ways to collect and report data efficiently, and implement the necessary practice changes to meet measure criteria and improve the quality of their practice.

Key Words: Imaging, radiology, quality and safety, performance measure, pay for performance, American College of Radiology

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INTRODUCTION

Landmark reports from the Institute of Medicine in the 1990s and 2000s revealed considerable gaps in the quality and safety of health care in the United States [1-3]. Since that time, public and private organizations and governments have increasingly focused on quality improvement, including the development of performance measures in medicine. A performance measure is a specific quantifiable indicator of an aspect of health care, expressed as a proportion or percentage of patients who are treated according to a specified standard. Performance measures typically focus on structures, processes, or outcomes of care [4,5]. With appropriate benchmarks, performance measures allow health care practitioners to identify areas within their practices that could be improved [4,5]. For example, the ACR National Radiology Data Registry provides benchmark information on numerous measures, allowing radiology practices to compare their performance measure data with other practices to determine performance gaps [6]. A sound methodologic approach to measuring these aspects of care should result in higher quality and more efficient care, as well as improved patient outcomes.

Although the primary intent for using performance measures is to improve health care quality, public and private payers also increasingly use them as a mechanism to establish a financial incentive for practitioners to improve quality and reduce costs [7]. Performance measures are now used in a variety of programs that adjust payments on an individual practitioner, group, or institutional level. These include several programs administered by CMS, such as the Physician Quality Reporting System (PQRS) with the PQRS Maintenance of Certification Program Additional Incentive, the Physician Value-Based Payment Modifier, the Hospital Outpatient Quality Reporting Program, and the Inpatient Quality Reporting Program with the associated Hospital Value-Based Purchasing (Table 1) [8-14].

The growing emphasis on pay-for-reporting and pay-for-performance programs, along with the need to identify radiologist-provided value-added aspects of care and services, spurred the ACR in 2004 to gather a group of quality-focused radiologists in Sun Valley, Idaho, to discuss a road map for improving quality in radiology [15]. Soon thereafter, CMS began to develop a physician quality reporting program and encouraged medical specialty societies to develop quality measures for use in the program. In 2006, the ACR evaluated the need for measure development, and the ACR Metrics Committee was then established to develop radiology performance measures [16,17]. The Metrics Committee began collaborating with the AMA's Physician Consortium for Performance Improvement (PCPI) for that purpose [18]. This collaboration resulted in several measure sets with imaging-related measures, many of which are currently used in the CMS PQRS [19]. In this paper, we focus on

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Dr Seidenwurm has received personal fees from Radiological Associates of Sacramento (Sacramento, California) during the conduct of the study, personal fees from Medical Legal Consulting (Houston, Texas), personal fees from the ACR (MR Accreditation Phantom) outside the submitted work, and various organizationally and government-sponsored performance measurement–related activities, as well as travel support, meals, lodging and clerical and technical support. Dr Rybicki has a research agreement with Toshiba Medical Systems Corporation (Tokyo, Japan) that is unrelated to this project.

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Table 1. CMS (selected) quality reporting and value-based purchasing programs

Incentive Program	Level of Application	Incentive/Year	Penalty/Year
PQRS	Physician/Group	0.50% (2013, 2014)	1.50% (2015)* 2.00% (2016, 2017)†
PQRS+MOC	Physician/Group	1.00% (2013, 2014)	1.50% (2015)* 2.00% (2016, 2017)†
VBPM	Physician/Group	+ TBD based on aggregate amount of downward payment for low-scoring groups (in 2015, groups of 100+; in 2016, groups of 10+)	−1.0% (in 2015 for groups of 100+ not participating in PQRS 2013, or low performing) −2.0% (in 2016 for groups of 10+ not participating in PQRS or low performing)
HOQR	Outpatient Facility	N/A	2.00% (FY2013) and beyond‡
HIQR	Inpatient Facility	N/A	2.00% (FY2013) and beyond§
HVBP	Inpatient Facility	Hospitals may earn an incentive payment % that is <, =, or > the applicable reduction % for that program year (shown as penalties in next cell)	Reduction in DRG payments, withheld: 2013: 1.0% 2014: 1.25% 2015: 1.5% 2016: 1.75% 2017: 2.0%

Note: DRG = diagnosis-related group; FY = fiscal year; HIQR = Hospital Inpatient Quality Reporting; HOQR = Hospital Outpatient Quality Reporting; HVBP = Hospital Value-Based Purchasing; MOC = Maintenance of Certification; NA = not applicable; PQRS = Physician Quality Reporting System; TBD = to be determined; VBPM = Physician Value-Based Payment Modifier.

*Based on 2013 data.

†Based on 2014 and 2015 data, respectively.

‡Hospitals must participate in data collection, submission, and public reporting of performance rates to receive the annual payment update on Hospital Outpatient Prospective Payment System services the following year.

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the typical process for the development of performance measures frequently used in such programs.

OVERVIEW OF MEASURE DEVELOPMENT

Performance measure development and implementation is a multiple-step process, beginning with identifying a clinical area that warrants dedicated attention. The project scope may include general imaging and radiology considerations and more specific topics such as radiation exposure and the appropriateness of certain imaging studies. Typically, once a focus area is selected, an environmental scan is conducted to gather relevant clinical practice guidelines and data to provide evidence that an improvement in the focus area is needed. After such a review, a multiple-stakeholder work group is established, composed of experts in various fields pertinent to the focus area. On the basis of the evidence and guidelines collected, the workgroup considers potential measures to draft, begins to develop and refine measure statements, and identifies numerator and denominator populations with any appropriate exclusion criteria. Technical specifications for refined measures are drafted, and data sources and data collection feasibility are assessed, potentially resulting in modification of the draft measure. After specification, candidate measures are tested for feasibility, reliability, validity, and unintended consequences.

Multiple variables carry weight in the final approval, endorsement, use, and sustainability of a measure. These include organizations involved in the measure development process (eg, medical specialties, payers, and consumer representatives), the intended purpose of the measure (eg, quality improvement, accountability, public reporting), and defined settings or levels of care (eg, physician, group, hospital, or system). A developed measure may proceed to the National Quality Forum (NQF) for endorsement consideration, or in some cases it may be implemented before endorsement. Measures may be used for public pay for reporting or pay for performance (such as with the various CMS programs), private payer pay for performance or quality tiering, hospital credentialing, or internal quality improvement initiatives.

Since the initial implementation of radiology measures in PQRS in 2007, requirements for endorsement and successive maintenance have become increasingly stringent. Measure testing is intended not only to ensure that measures can improve clinical structures, processes, and outcomes but also to improve the effectiveness of the measures. Measures fully endorsed by the NQF must be maintained over a 3-year cycle, with annual updates required. At each juncture, performance measures are reevaluated for continued relevance. A performance measure may conclusively remain as is, undergo modification, be harmonized with related measures, or be retired. The purpose of this article is to describe a measure's "life span," emphasizing key elements particularly relevant to measures intended for radiology (Fig. 1).

Part 1: Topic Selection

Currently, nearly 700 measures have been endorsed by the NQF through the innovation and commitment of

80 measure developers or stewards; these measures are accessible at the NQF's website [20]. The opportunity to expand on the existing measures is not limited to affluent and influential organizations. Individuals, hospitals, health insurance providers, specialty societies, and other consortia are equally empowered to steward the process.

The measure development process begins with the selection of an appropriate topic area in need of quality improvement. A measure development organization, such as the PCPI, conducts a background review to compile clinical practice guidelines and relevant research identifying evidence for measure need in 3 areas: (1) evidence demonstrating a high-priority aspect of health care or addressing a specific national health goal or priority (eg, the National Quality Strategy priorities; Table 2) [21]; (2) evidence to support the measure focus, such as leading to a desired health outcome; and (3) evidence of a gap or variation in care. Additionally, an environmental scan is conducted to identify existing performance measures relevant to the focus area. In one hypothetical pathway, a performance measure workgroup has identified a variation in radiology reports. Specifically, for carotid imaging studies, including CT angiographic, MR angiographic, carotid ultrasound, and neck angiographic studies, these reports do not confirm that the methods for stenosis measurement are those validated in randomized controlled outcome trials as best practice. Failure to provide this information in the report may cause uncertainty for physicians considering treatment planning and potentially may lead to adverse events for patients, including delayed patient care, unnecessarily repeated imaging studies, inappropriate interventions, or poor outcomes.

Part 2: Measure Development

Although anyone has the power to initiate and develop a performance measure, those intended for widespread use are frequently managed by organizations that specialize in measures development. Historically, one such organization has been the PCPI, with a focus of physician-level measurement. Although the PCPI has frequently overseen measure development, it should be emphasized that its involvement is not mandatory for measure endorsement and implementation. The process the PCPI follows is described below as a generally accepted approach used for measure development.

The PCPI follows a well-defined, structured process for measure development [22]. Measure development in the PCPI is an evidence-based and consensus-based process. Once the focus for potential clinical improvement is identified as described above, an interdisciplinary work group is convened, often with representatives of multiple physician specialties, patients, and other health care consumers; payers such as private health insurance companies; members of other measure development organizations (such as the National Committee for Quality Assurance); and coding and specification experts. The purpose of this workgroup may be twofold: to build and test a performance measure and/or to assess existing performance measures for continued suitability in addressing a defined clinical need.

Upon formation, the work group reviews the state of the evidence gathered on the focus or topic areas

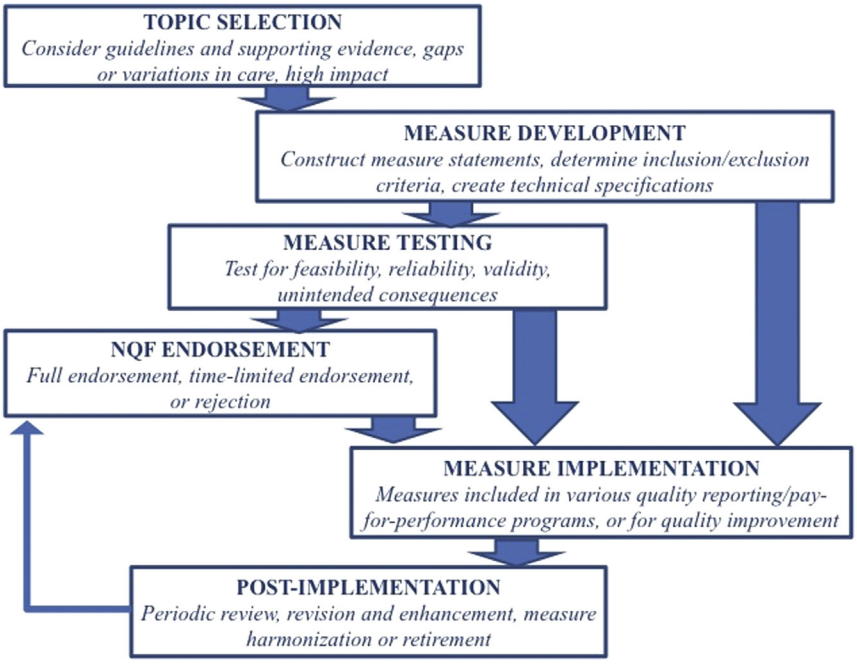

Fig 1. Performance measure life span.

Table 2. Agency for Healthcare Research and Quality National Quality Strategy priorities

- Making care safer by reducing harm caused in the delivery of care.
- Ensuring that each person and family is engaged as partners in their care.
- Promoting effective communication and coordination of care.
- Promoting the most effective prevention and treatment practices for the leading causes of mortality, starting with cardiovascular disease.
- Working with communities to promote wide use of best practices to enable healthy living.
- Making quality care more affordable for individuals, families, employers, and governments by developing and spreading new health care delivery models.

identified. Measure development progresses with discussion centering on an established clinical question, to determine which practices lead to better or worse care and to reach consensus on the best measure structure. Additional literature searches may be performed, and new studies may be conducted if insufficient evidence exists to support the basis for the measure. An assessment of the potential impact of the proposed measure is also made.

Once the evidence review and impact analysis are conducted, an eligible population with defined inclusion and exclusion criteria is identified for a proposed measure. The total eligible population is considered the denominator of a measure. A numerator is also determined, representing the subset of the denominator that meets the expected measure criterion. For example, a measure already exists for the carotid imaging reporting case previously described, with the denominator representing all finalized carotid imaging study reports, including neck MR angiography, neck CT angiography, neck duplex ultrasound, and carotid angiography [23]. The measure assesses whether the radiology report makes "direct or indirect reference to measurements of distal internal carotid diameter as the denominator for stenosis measurement." The numerator in this case is the subset of finalized carotid imaging study reports that make (direct or indirect) reference to measurements of distal internal carotid diameter as the denominator for stenosis measurement. For example, to fulfill numerator criteria, measurements of stenosis are required to make reference to established, validated criteria for measurement, such as the North American Symptomatic Carotid Endarterectomy Trial methodology. Technical specifications, including the relevant International Classification of Diseases, ninth rev, Clinical Modification, Current Procedural Terminology (CPT), and CPT category II codes, and other code sets, are created after the population has been defined.

During the PCPI measure development process, after full work group review and input, measures are posted online for a 30-day public comment period. During this window, PCPI members, nonmember health care providers and consumers, and other health care stakeholders may submit comments, which may lead to the revision of a proposed measure. After appropriate revision, measure specifications are refined, and the resulting measure set is put to vote by the PCPI membership. The membership consists primarily of national medical specialty societies but also includes several medical specialty boards, state medical societies, and numerous other health care professional organizations.

After PCPI approval, the finalized measure set then undergoes a testing process, during which it is assessed for feasibility, reliability, validity, and unintended consequences [24]. *Feasibility* refers to how easily a practice can implement a measure, integrate it into the workflow, and collect data for reporting purposes. *Reliability* refers to the extent to which different raters can obtain similar numerators and denominators for a measure and whether data collection and measure rate calculations result in the same findings across different data collection methods, such as electronic health records, registries, claims, and paper medical records. *Validity* refers to whether a measure truly reflects the clinical area it intends to capture. The evidence base may be revisited to confirm the scientific merit of a proposed measure, and a comparison with other measures may be made.

An independently developed measure may receive PCPI approval. For approval, the independent developer must be a voting member of the PCPI, the PCPI must be represented on the measure development panel from the beginning of the process, and the PCPI methodology must be adopted for measure development.

Part 3: NQF Endorsement

After development, a measure steward (such as the PCPI, a medical institution, or a specialty organization) may submit the measure to the NQF for endorsement. The NQF is a not-for-profit, multiple-stakeholder organization whose mission is to develop and implement a strategy for health care performance measurement and reporting, aligned with national goals. The endorsement process provides an additional level of measure analysis, consensus development, and feedback. Endorsed measures are considered "reference standard" measures that are often widely adopted for pay-for-performance, reporting, or credentialing purposes. In general, NQF endorsement is statutorily required for a measure to be implemented by several CMS programs, with some exceptions.

The NQF's process for evaluating measures uses 5 standard criteria that are similar to the criteria used by the PCPI for measure development: (1) impact or priority, evidence of a quality gap, and evidence to support its focus; (2) reliability and validity of measure results; (3) usability; (4) feasibility; and (5) comparison with similar measures [25].

The NQF has a formalized consensus development process that can be understood through 8 general steps [26]. As previously discussed, once an individual or

organization has decided to proceed through development with a novel measure or set of measures, the steward would find an appropriate upcoming NQF "project" relevant to its measure(s). NQF will convene a steering committee and sometimes a technical advisory panel for the project work. Titled a "call for nominations," this is the first step to organized and efficient measure evaluation. The second step, or "call for candidate standards," is an open period for measure stewards to submit candidate measures or medical best practices using an online form. Once the call period has ended, the steering committee (sometimes in the company of the technical advisory panel) will evaluate the submitted measures by consensus to determine recommendations for moving the measures forward for further endorsement review. Measures may either move forward to the next steps of the consensus development process or require further development by the steward before advancing and possible endorsement. This decision phase, "candidate consensus standard review," is step 3 of the NQF process.

For measures approved by the committee for progression toward endorsement, a draft report of the committee measure recommendations is posted online. This information is accessible to NQF members and the public, and comments can be offered by any of these parties. The committee then reviews these suggestions to determine if any changes should be made to the recommendations in the consensus review draft report. This "public and member comment," or step 4 of the NQF consensus development process, precedes step 5, "member voting" on the candidate measure by all members of the NQF for endorsement. If the majority vote approves measure endorsement, step 6 of the NQF process leaves the fate of the measure to the Consensus Standards Approval Committee, which meets 3 times a year to review candidate measures and determine if appropriate consensus has been reached, according to the criteria for review with regard to the steering committee recommendations. The Consensus Standards Approval Committee takes into account steering committee draft reports, public comments, and the final voting results before granting full endorsement, granting time-limited endorsement, or denying the endorsement of a candidate measure.

Full endorsement for a measure extends 3 years before a full mandatory review, although annual updates are performed. In select cases, a measure may receive time-limited endorsement, with only 1 year of approved measure use before review, and additional evidence to support the validity, reliability, usability, or feasibility of the measure may be required. If the Consensus Standards Approval Committee has made a positive recommendation for a measure (full or time-limited endorsement), it is then sent to the Board of Directors for final approval. Once "board ratification," step 7 of the process, has been achieved, the measures are published online and accessible to the public. Should anyone dispute the final decision of the Board of Directors, a 30-day postendorsement window exists for formal appeal, the eighth and final step of the NQF measure development process.

Part 4: Measure Implementation

Once a measure has been developed and/or endorsed, it may be used by a variety of agencies, hospitals, physician groups, health insurance companies, and other health care entities. NQF endorsement may or may not be a prerequisite to measure implementation. Measures used for pay-for-performance, pay-for-reporting, accreditation, or maintenance of certification purposes often have NQF endorsement. Measures used for internal quality improvement may or may not have NQF endorsement.

In many quality reporting programs, data for quality measures are typically extracted from claims information or patient medical records. For the PQRS, the Inpatient Quality Reporting Program and the Hospital Outpatient Quality Reporting Program online manuals describe how to implement the available measures, including the relevant patient demographics, International Classification of Diseases, ninth rev, Clinical Modification and CPT codes, and how to calculate the numerator and denominator [23,27-29]. For example, relevant CPT codes for PQRS measure 195 (NQF 0507), "Stenosis Measurement in Carotid Imaging Reports," include codes for neck MR angiography, neck CT angiography, neck duplex ultrasound, and carotid angiography. A CPT category II code exists for satisfactory reporting of the quality measure. Eligible CPT and International Classification of Diseases, ninth rev, Clinical Modification codes are explicitly listed for each measure, as are the inclusion and exclusion criteria.

To tally groups in the numerator and denominator accurately, cases subject to inclusion and exclusion should be documented. Criteria for exclusion may include medical-related, patient-related, or systems-related reasons. Excluded cases should have an appropriate modifier to the CPT category II codes for the measure.

Part 5: Postimplementation Testing and Maintenance

Measure data that are gathered after measure development or endorsement are applied for the purposes of quality improvement and accountability. Every 3 years, an NQF fully endorsed measure undergoes periodic maintenance review and enhancement, an evaluation process to ensure that measures remain relevant and continue to reflect best practices. Specifications (eg, adding a new imaging modality) may be updated at any time on the basis of feedback or new evidence. The measure steward is responsible for submitting updated information to the NQF. Failure to do so results in a lapse of NQF endorsement.

Measure maintenance also provides an opportunity for harmonization with other, similar measures. An ad hoc review of an endorsed measure may be requested

Table 3. 2013 Physician Quality Reporting System measures most applicable to radiologists

Measure Set	Measure	Most Applicable Subspecialty
Cardiac stress imaging	Preoperative Evaluation in Low-Risk Surgery Patients	IR, DR
	Routine Testing After Percutaneous Coronary Intervention	
	Testing in Asymptomatic, Low-Risk Patients	
Critical care	CVC Insertion/Sterile Barrier Technique	IR
Nuclear medicine	Correlation of Bone Studies	NM
Oncology	Hormonal Therapy	RO
	Colon Cancer: Chemotherapy for AJCC Stage III Colon Cancer Patient	
	Pain Intensity Quantified	
	Plan of Care for Pain	
	Tissue Dose Constraints	
	Cancer Stage Documented	
Osteoporosis	Communication Following Fracture	DR, IR
	Management Following Fracture	
Prostate cancer	Bone Scan Overuse - Staging	RO
	Adjuvant Hormonal Therapy	
Radiology	Fluoroscopy Exposure/Time Recorded	DR, IR
	Inappropriate Use of BIRADS 3	
	Stenosis Measurement in Carotid Imaging Studies	
	Reminder System for Mammograms	
Perioperative care	Timing of Antibiotics-Ordering Physician	IR
	Selection of Antibiotic	
	Discontinuation of Antibiotic	
	VTE Prophylaxis	
Radiation safety	Reporting to a Radiation Dose Index Registry	DR, IR, NM
	Utilization of a Standardized Nomenclature for CT Imaging Description	
	Appropriateness: Follow-up CT Imaging for Incidental Pulmonary Nodules According to Recommended Guidelines	
	Cumulative Count of Potential High Dose Radiation Imaging Studies: CT Studies and Cardiac Nuclear Medicine Studies	
	Search for Prior CT Studies through a Secure, Authorized, Media-free, Shared Archive	
	CT Images Available for Patient Follow-up and Comparison Purposes	

Note: AJCC = American Joint Committee on Cancer; CVC = central venous catheter; DR = diagnostic radiology; IR = interventional radiology; NM = nuclear medicine; RO = radiation oncology; VTE = venous thromboembolism.

and is granted on a case-by-case basis. At the end of this evaluation process, a measure may be kept, modified, or harmonized with other measures, or retired if it is no longer clinically relevant.

For example, PQRS measure 10, which measured the documentation rate of the presence or absence of stroke, hemorrhage, or mass on brain CT and MRI reports, was retired by the NQF at the end of 2012. Stated reasons for retirement included a lack of evidence supporting whether the actual documentation of the presence or absence of these results affected outcomes or would change practice, as well as the fact that tissue plasminogen activator was often administered long before the report was finalized. For these and other reasons, the NQF determined that the measure did not meet the criteria for importance to measure and report, and the measure is no longer listed in its endorsed measures set [30].

CONSIDERATIONS FOR RADIOLOGISTS

Although data on the effectiveness of pay-for-performance initiatives have thus far been varied [31-34], Congress has mandated the institution of a variety of programs that will increasingly affect reimbursement for individual practitioners, groups, and institutions. Limitations of currently instituted performance measures include wide variation in background evidence, limitations in the sources of data collection, and a lack of evidence that process measures affect outcomes [35]. Moreover, relatively few measures assess important clinical issues such as the rate of diagnostic errors and the appropriateness of diagnostic studies and therapies [36,37]. A recent report by the Robert Wood Johnson Foundation made 7 policy recommendations for improving the application of performance measurement, including that performance measures focus on outcomes instead of processes, that they measure patient experience of care, and that quality measures be used in conjunction with other quality initiatives [37].

Nonetheless, performance measures are important for radiologists because they allow the identification of quality gaps and the assessment of opportunities for improvement and because reporting is being increasingly tied to reimbursement. Performance measurement against defined benchmarks, such as national, regional, or registry-based benchmarks including the ACR National Radiology Data Registry, provides information

that allows radiology practices to assess their performance gaps and plan for quality improvement. Radiologists should also be involved in developing performance measures so that new measures are clinically relevant and best reflect what is important for patients, referring providers, and a radiology practice.

Although any individual or group can draft a performance measure and steward the measure to NQF endorsement, the ACR Metrics Committee has been involved in developing most of the radiology-specific measures currently in use in the CMS PQRS program. At present, the active Radiology Measure Set is being updated with several new draft measures. Many of these draft measures focus on recommendations related to incidental findings and unnecessary follow-up imaging.

Measures may be designed for the goal of NQF endorsement and use in pay-for-performance programs, or they may be developed for limited quality improvement programs within a practice. Some radiology-specific measures that receive NQF endorsement and CMS implementation are likely to be outcomes based, and when applicable, future measures should be rigorously supported by evidence that demonstrates an improved outcome. In choosing measures for implementation and reporting, it is important for radiologists to have measures that are relevant to imaging. There are nearly 700 NQF-endorsed measures, but only a small number are relevant to radiologists, and some apply only to interventional procedures (Table 3). Also, for many measures that include imaging as an element, the desired measure result is often attributed to the treating or referring physician and not the radiologist. Developing radiology-specific outcome measures may be a challenge as the correct performance, interpretation, and reporting of an imaging study may only contribute indirectly to a good patient outcome. A key goal of the ACR Metrics Committee within the Commission of Quality and Safety is to develop measures attributable to radiologists. Although this is an ongoing process, radiologists should familiarize themselves with the complex family of public and private programs now using measures to modify reimbursement. It is also incumbent on radiology practices to develop plans for data gathering so that quality gaps can be identified and data easily reported for reimbursement purposes.

CONCLUSIONS

Performance measures are now an established component of quality assessment and reimbursement in health care and will only grow in importance. Measures development first entails identifying a clinical area in need of improvement and is a multiple-step process that requires evidence gathering, specifying inclusion and exclusion criteria, and testing. A developed measure may be further submitted to the NQF for endorsement; endorsed measures are then typically used in value-based purchasing programs. Implemented measures routinely undergo maintenance and may be revised, harmonized with other measures, or retired depending on evolving best practices. Radiologists should be involved in measure development to ensure that they are clinically important and relevant to a radiology practice.

TAKE-HOME POINTS

- Performance measures are now an established component of quality assessment and reimbursement in health care and will continue to grow in importance and use.
- Measure development is a multiple-step process that begins with identifying a clinical area in need of improvement, followed by gathering evidence. It continues with appropriate specification, then testing of validity and usability. A developed measure may be further submitted for NQF endorsement.
- Once developed or endorsed, measures may be implemented by value-based purchasing programs to determine reimbursement.
- Radiologists should be involved in measure development to ensure that new measures are clinically important to a radiology practice.

REFERENCES

1. Kohn L, Corrigan J, Donaldson M, eds. To err is human: building a safer health system. Washington, District of Columbia: National Academy Press; 1999.
2. Institute of Medicine, Committee on Quality of Health Care in America. Crossing the quality chasm: a new health system for the 21st century. Washington, District of Columbia: National Academy Press; 2001.
3. Hurtado MP, Swift EK, Corrigan JM, eds. Envisioning the national health care quality report. Washington, District of Columbia: National Academy Press; 2001.
4. Donabedian A. Evaluating the quality of medical care. Milbank Mem Fund Q 1966;44(suppl):166-206.
5. Donabedian A. The quality of care. How can it be assessed? JAMA 1988;260:1743-8.
6. American College of Radiology. National Radiology Data Registry. Available at: http://www.acr.org/Quality-Safety/National-Radiology-Data-Registry. Accessed November 10, 2013.
7. VanLare JM, Conway PH. Value-based purchasing—national programs to move from volume to value. N Engl J Med 2012;367:292-5.
8. Centers for Medicare and Medicaid Services. Physician Quality Reporting System. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/PQRS/index.html. Accessed June 16, 2013.
9. Centers for Medicare and Medicaid Services. Maintenance of Certification Program incentive. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/PQRS/Maintenance_of_Certification_Program_Incentive.html. Accessed June 16, 2013.
10. Centers for Medicare and Medicaid Services. Medicare FFS Physician Feedback Program/Value-Based Payment Modifier. Available at: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeedbackProgram/ValueBasedPaymentModifier.html. Accessed June 16, 2013.
11. Centers for Medicare and Medicaid Services. Hospital Outpatient Quality Reporting Program. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalOutpatientQualityReportingProgram.html. Accessed June 16, 2013.

12. Centers for Medicare and Medicaid Services. Hospital Inpatient Quality Reporting Program. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalRHQDAPU.html. Accessed June 16, 2013.

13. Anumula N, Sanelli PC. National initiatives for measuring quality performance for the practicing neuroradiologist. Neuroimaging Clin North Am 2012;22:457-66.

14. Becker GJ, Bosma JL, Burleson J, Borgstede JP. Introduction to value-based payment modifiers. J Am Coll Radiol 2012;9:718-24.

15. Johnson CD, Swensen SJ, Applegate KE, et al. Quality improvement in radiology: white paper report of the Sun Valley Group meeting. J Am Coll Radiol 2006;3:544-9.

16. Moser JW, Wilcox PA, Bjork SS, et al. Pay for performance in radiology: ACR white paper. J Am Coll Radiol 2006;3:650-64.

17. American College of Radiology. Quality measurement. Available at: http://www.acr.org/Quality-Safety/Quality-Measurement. Accessed June 16, 2013.

18. American Medical Association. Physician Consortium for Performance Improvement. Available at: http://www.ama-assn.org/ama/pub/physician-resources/physician-consortium-performance-improvement.page. Accessed June 16, 2013.

19. American College of Radiology. 2013 Physician Quality Reporting System (PQRS): measures potentially applicable to radiology (diagnostic, interventional, nuclear medicine and radiation oncology. Available at: http://www.acr.org/~/media/ACR/Documents/P4P/Resources/2013/PQRS%20Radiology%20Measures%20Table%20with%20Descriptions.pdf. Accessed June 16, 2013.

20. National Quality Forum. Quality Positioning System. Available at: http://www.qualityforum.org/QPS/. Accessed June 16, 2013.

21. Agency for Healthcare Research and Quality. About the National Quality Strategy. Available at: http://www.ahrq.gov/workingforquality/about.htm. Accessed November 14, 2013.

22. American Medical Association. Physician Consortium for Performance Improvement: about our measure development. Available at: http://www.ama-assn.org/ama/pub/physician-resources/physician-consortium-performance-improvement/pcpi-measures/about-measure-development.page. Accessed June 16, 2013.

23. Centers for Medicare and Medicaid Services. 2013 Physician Quality Reporting System (PQRS) claims/registry measure specifications manual, version 7.2. Available at: http://www.cms.gov/apps/ama/license.asp?file=/PQRS/downloads/2013_PQRS_IndClaimsRegistry_MeasureSpec_SupportingDocs_12192012.zip. Accessed June 16, 2013.

24. American Medical Association. Measure testing protocol for physician consortium for performance improvement performance measures. Available at: http://www.ama-assn.org/resources/doc/cqi/pcpi-testing-protocol.pdf. Accessed June 16, 2013.

25. National Quality Forum. Measure evaluation criteria. Available at: http://www.qualityforum.org/Measuring_Performance/Submitting_Standards/Measure_Evaluation_Criteria.aspx. Accessed June 16, 2013.

26. National Quality Forum. Consensus development process. Available at: http://www.qualityforum.org/Measuring_Performance/Consensus_Development_Process.aspx. Accessed June 16, 2013.

27. Centers for Medicare and Medicaid Services. 2013 Physician Quality Reporting System (PQRS) implementation guide—claims-based reporting for incentive, version 7.1. Available at: http://www.cms.gov/apps/ama/license.asp?file=/PQRS/downloads/2013_PQRS_MeasuresList_ImplementationGuide_12192012.zip. Accessed June 16, 2013.

28. Hospital outpatient quality reporting specifications manual, v6.0b. Available at: http://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FSpecsManualTemplate&cid=1228772438492. Accessed June 16, 2013.

29. Hospital Inpatient Quality Reporting Program: handbook IV: specifications manual for national hospital inpatient quality measures. Available at: http://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FSpecsManualTemplate&cid=1228772438492. Accessed June 16, 2013.

30. National Quality Forum. Neurology endorsement maintenance—phase I technical report. Available at: http://www.qualityforum.org/Publications/2012/12/Neurology_Endorsement_Maintenance_-_Phase_I_Technical_Report.aspx. Accessed June 16, 2013.

31. Ryan AM, Blustein J. The effect of the MassHealth hospital pay-for-performance program on quality. Health Serv Res 2011;46:712-28.

32. Ryan AM, Nallamothu BK, Dimick JB. Medicare's public reporting initiative on hospital quality had modest or no impact on mortality from three key conditions. Health Aff (Millwood) 2012;31:585-92.

33. Jha AK, Joynt KE, Orav EJ, Epstein AM. The long-term effect of premier pay for performance on patient outcomes. N Engl J Med 2012;366:1606-15.

34. Sutton M, Nikolova S, Boaden R, Lester H, McDonald R, Roland M. Reduced mortality with hospital pay for performance in England. N Engl J Med 2012;367:1821-8.

35. Nicolas LH, Osborne NH, Birkmeyer JD, Dimick JB. Hospital process compliance and surgical outcomes in Medicare beneficiaries. Arch Surg 2010;145:999-1004.

36. Wachter RM. Why diagnostic errors don't get any respect—and what can be done about them. Health Aff (Millwood) 2010;29:1605-10.

37. Berenson RA, Pronovost PJ, Krumholz HM. Achieving the potential of health care performance measures: timely analysis of immediate health policy issues. Princeton, New Jersey: Robert Wood Johnson Foundation and Urban Institute; 2013.